Framing Living Space Over a Garage

Either engineered lumber or conventional framing can provide a clear-span garage space

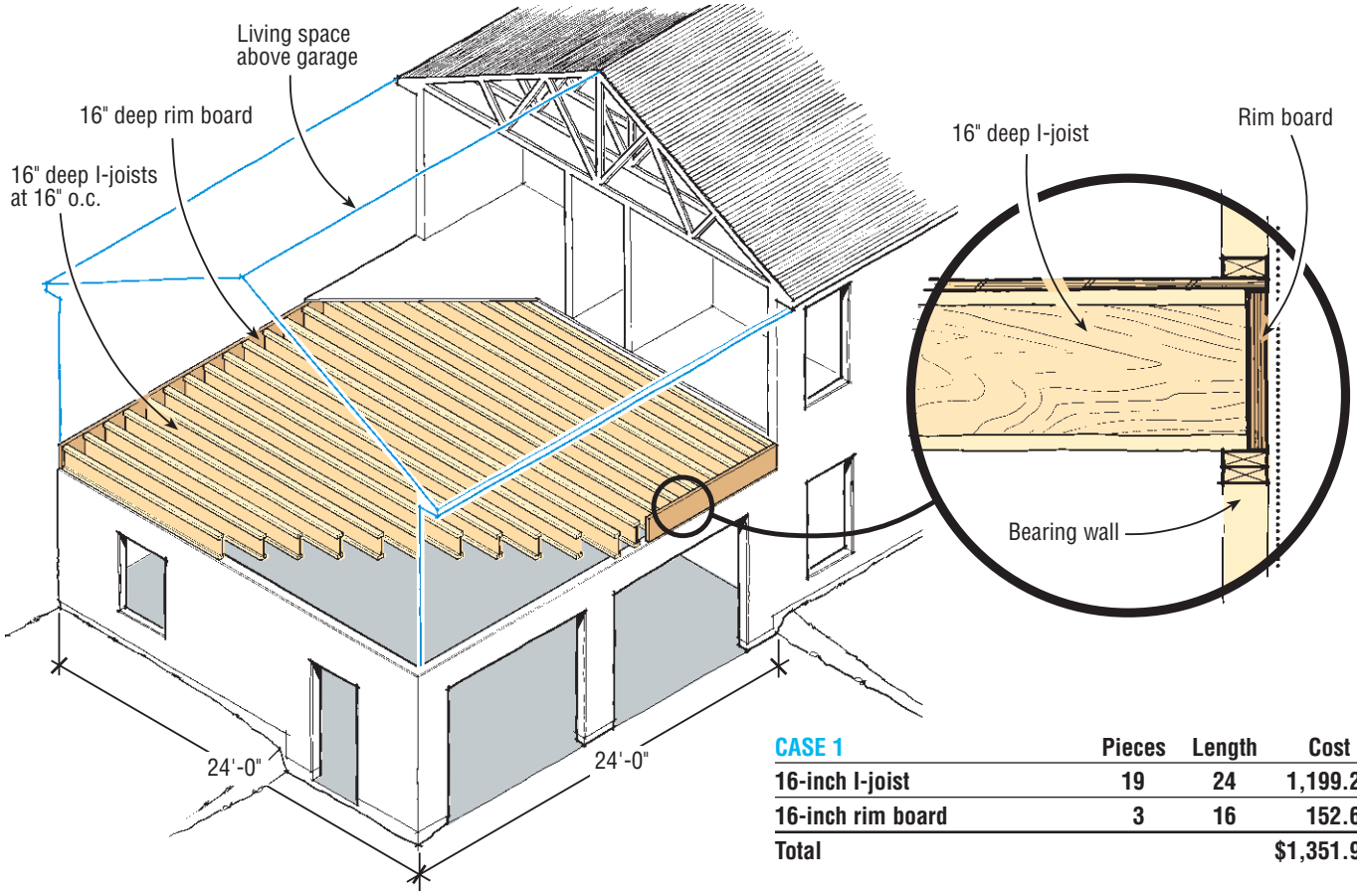
by Joe Madera

Tucking an attached garage under a second-story living space is a common practice in residential design. When a client opts to do this, an important consideration is how to maintain open space within an oversized two-car garage without the interference of supporting columns. In this article, we'll look at four separate scenarios for framing the span over a typical 24x24-foot garage. These scenarios cover only the floor system, not the overhead garage door headers or possible stair openings. Nonetheless, these framing elements should be carefully specified and installed to ensure the integrity and performance of the structure as designed. Many builders and framers still shy away from using an engineered-wood floor system in the belief that it is always the most expensive option. But let's compare some examples to see if there's any merit to that belief.

Case 1: Clear-Spanning I-Joists

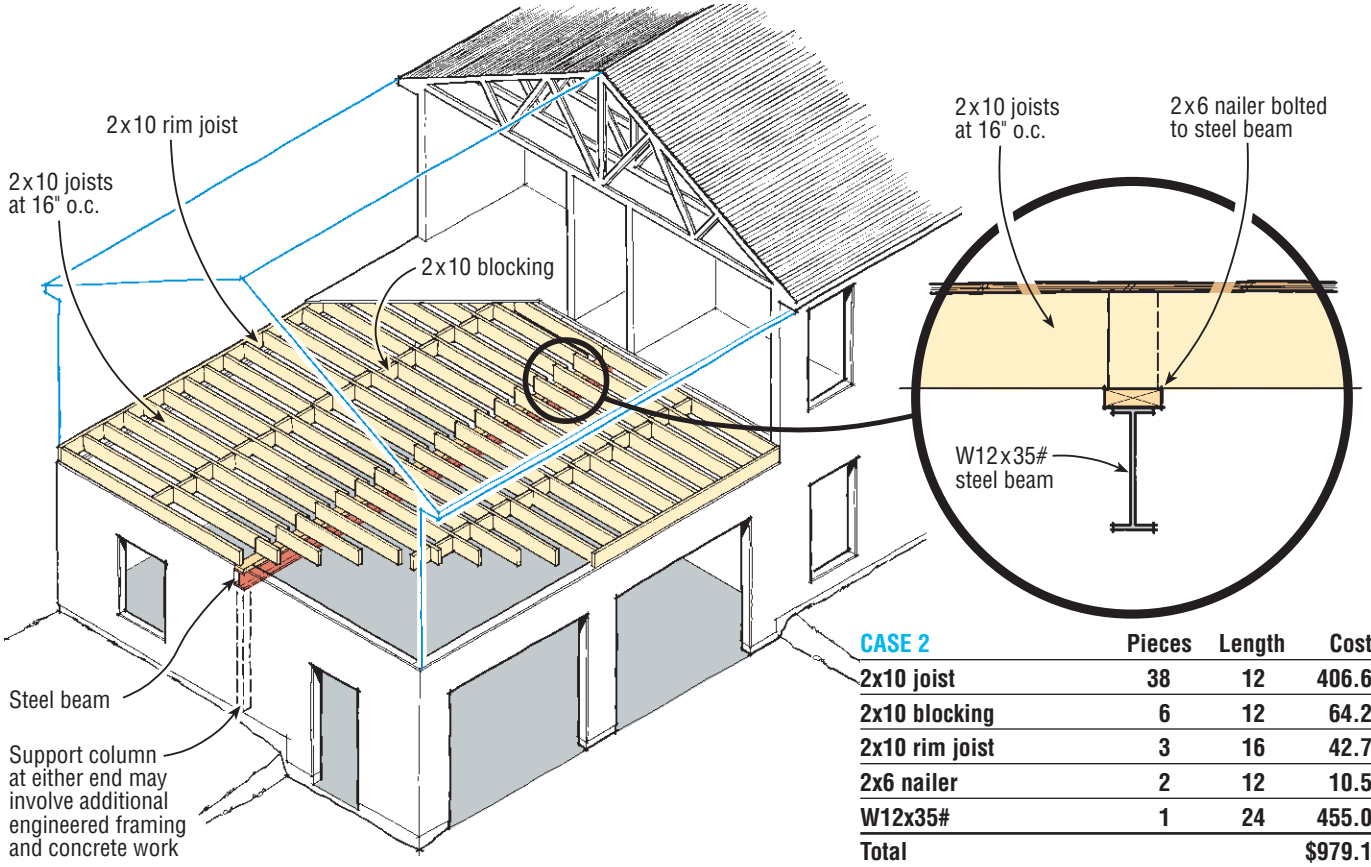
In our first garage remodel, we'll specify an I-joist floor system, using 16-inch-deep joists, spaced at 16 inches on-center. The total deflection is L/600, or .54-inches, using a 40-psf live load and a 10-psf dead load. This design is suitable when true living space is planned above, such as a living room or a master-bedroom suite, as opposed to an occasional-use room or a storage space. This floor system would require nineteen 24-foot lengths of a suitable 2 1/4x16-inch I-joist, such as a BCI-60, LPI-36, or TJI-350, and 48 linear feet of rim board. At around $1,352 for this package, engineered lumber isn't the least expensive material you can buy, but this system requires only a total of 21 pieces of material to complete it, producing a significant savings in handling and installation labor (see Case 1 illustration). Although some designs indicate that a 14-inch-deep joist is adequate for this span, experience has shown that, with a 40-psf live load and .81 inch of total deflection, most users consider the "feel" of the 14-inch joist to be too springy. If the space is used very little — as a storage room, for example — the smaller joist may be sufficient. It's true that not every design, particularly in the case of an addition, is able to accommodate such a deep joist as a continuation of an existing second-floor framing system. But, in new construction, adjustments can be made to the ceiling

Case 1: Clear-Spanning I-Joists



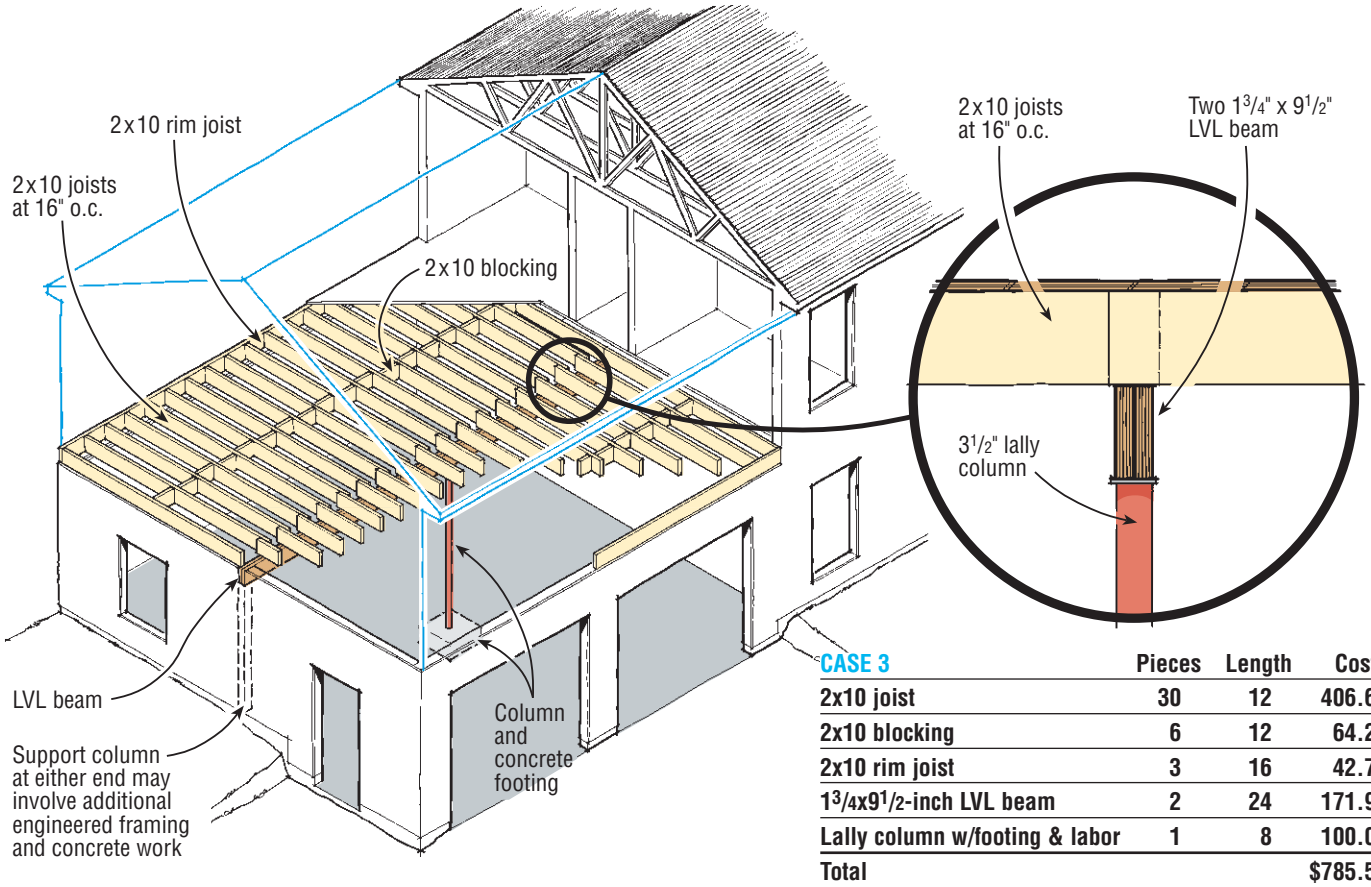
CASE 1	Pieces	Length	Cost
16-inch I-joist	19	24	1,199.28
16-inch rim board	3	16	152.64
Total			$1,351.92

Case 2: Steel Carrying Beam



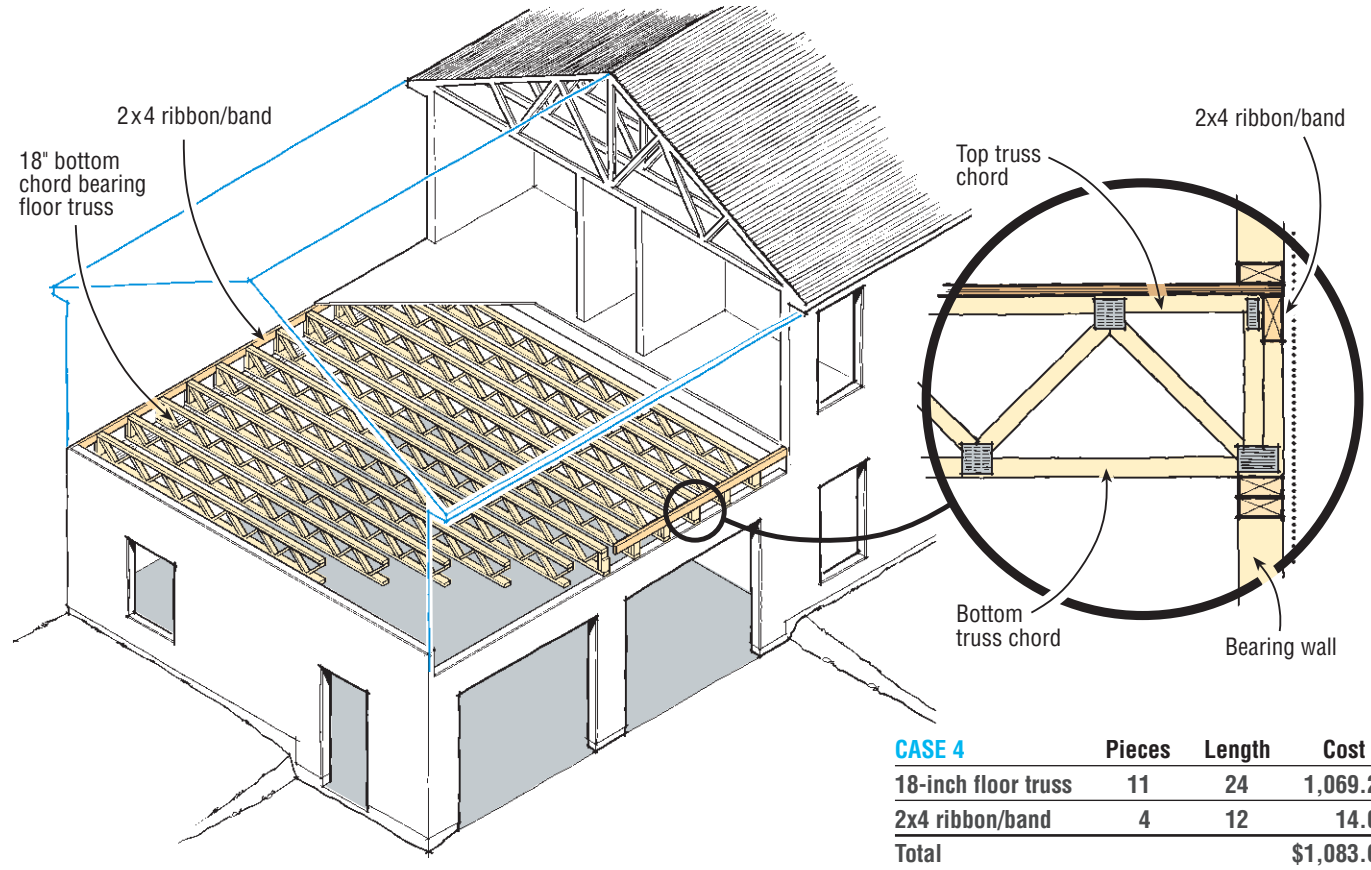
CASE 2	Pieces	Length	Cost
2x10 joist	38	12	406.60
2x10 blocking	6	12	64.20
2x10 rim joist	3	16	42.78
2x6 nailer	2	12	10.52
W12x35#	1	24	455.00
Total			$979.10

Case 3: Multi-Span LVL Beam



CASE 3	Pieces	Length	Cost
2x10 joist	30	12	406.60
2x10 blocking	6	12	64.20
2x10 rim joist	3	16	42.78
1 3/4x9 1/2-inch LVL beam	2	24	171.96
Lally column w/footing & labor	1	8	100.00
Total			$785.54

Case 4: Open Web Floor Trusses



CASE 4	Pieces	Length	Cost
18-inch floor truss	11	24	1,069.20
2x4 ribbon/band	4	12	14.04
Total			$1,083.64

height or floor elevation of the garage to allow for a continuous, unbroken floor transition to an abutting upstairs room.

Case 2: Steel Carrying Beam

The second example divides the 24-foot span in half, while still retaining an open, column-free floor plan below. This design uses a steel beam as the central carrying member, with 2x10 floor joists spaced at 16 inches on-center (Case 2 illustration, page 2). Using a 40-psf live load, we get around .57 inch of total deflection. The joists tie to a wood plate fastened to the top flange of the beam. This is a common building technique that has been around for quite some time, and it requires no special technology or skills to assemble. At first glance, this method appears to be the easiest, but let's take a closer look at some interesting details.

This design requires thirty-eight 12-foot 2x10 joists, 24 feet of 2x6 for the nailer that is bolted to the beam, six 12-foot 2x10s for the perimeter joists and blocking, plus a 24-foot steel beam — a W12x35# in this case, weighing 875 pounds. The cost of the materials for this system rings up at about $979, but the column detail to support this beam at either end might involve additional engineered framing or concrete work as well.

While this method of construction is pretty straightforward and familiar, we've more than doubled the number of pieces that must be handled. The labor required to install the steel also adds significant cost to this system; it's quite likely that you'll want to hire a crane to set the steel beam.

Case 3: Multi-Span LVL Beam

The third scenario uses the same basic system as above, but with the addition of one column at the mid-point, cutting the beam span in half. The column allows us to get rid of the 875-pound piece of steel, but it does leave us with a post in the middle of the garage floor below. This is a fairly common installation, so obviously it's not always objectionable.

In this case we've replaced the steel beam with two 1 3/4x9 1/2-inch LVL members, site-laminated to form a 3 1/2-inch-thick unit, supported at mid-span by the column (Case 3 illustration).

The multiple span application of the LVL allows us to use this relatively small beam, which saves on headroom in the garage. The downside, of course, is the compromising column in the center of the garage. The column costs about $100, including a concrete footing pad and added labor. While this solution doesn't fill the requirement for absolutely open garage space, and won't be suitable for every situation, at least we've gotten rid of the heavy steel beam and no longer need to book a crane. And, no special framing techniques are required. We also end up with a reasonable $786 price tag for materials.

Case 4: Open Web Floor Trusses

The final option involves using open web floor trusses to frame the floor system, getting us back to a 24-foot clear span. This version uses 18-inch-deep floor trusses, spaced 24 inches on-center, totaling a mere 11 trusses — a cleat carries the floor at the end walls — plus 48 feet of 2x4 ribbon to tie the trusses together (Case 4 illustration). Many truss manufacturers consider this a stock truss and offer it at considerable savings, as little as $1,083 for this package. On the negative side, if an opening for stairs is required, shorter, custom trusses must be made to order. Furthermore, many plans will be unable to accommodate such a deep truss, due to the shallower depth of the floor joists in abutting sections of the structure. It is possible, of course, to lower the bearing wall plate in the garage, and consequently the ceiling, to compensate for the extra depth, or incorporate a step up into the room over the garage, but these are only marginal solutions unlikely to suit every situation. A top-chord-bearing truss might also work, but most truss manufacturers do not consider this to be a stock truss.

Joe Madera *is an engineered-wood products specialist and designer for Shepley Wood Products in Hyannis, Mass.*